

### 3.3 HYDROLOGY AND WATER QUALITY

Surface water bodies that could potentially be affected by the proposed project include the Columbia River, the Umatilla River and Butter Creek. Shallow and deep groundwater aquifers underlie the project area and could also be affected by the proposed project.

#### 3.3.1 Affected Environment

The proposed project area is located on the Umatilla Plateau, which slopes gently from the Blue Mountains to the edge of the Columbia River Gorge. Slopes are generally less than 5 percent. Elevations in the vicinity of the proposed project vary from about 213 meters (700 feet) above sea level at the connection point with the GTN natural gas pipeline to 91 meters (300 feet) above sea level at the McNary Substation. The project area is in the rain shadow of the Cascade Mountains and is arid, receiving slightly less than 23 centimeters (nine inches) of precipitation annually. Most precipitation occurs between October and April.

#### Surface Water

##### *Regional Hydrology*

The proposed project lies within the Columbia-Umatilla Plateau hydrologic sub-basin of the perennial Umatilla River. The Umatilla River drains an area of 7,313 km<sup>2</sup> (4,545 mi<sup>2</sup>) and joins the Columbia River at the city of Umatilla, about 13 kilometers (eight miles) north of the proposed power plant site. The proposed power plant site lies approximately 1.5 kilometers (1.0 mile) west of the Umatilla River.

The other significant natural drainage feature in the vicinity of the proposed project is Butter Creek, a tributary of the Umatilla River. Butter Creek is an intermittent stream that joins the Umatilla River about 3.2 kilometers (2.0 miles) upstream of the power plant site. A portion of the flow of Butter Creek is diverted into the Westland Canal, an irrigation canal that flows through the eastern portion of the proposed power plant site. Surface water features in the vicinity of the proposed project are shown in Figure 3.2.1.

The Columbia River is the region's dominant surface water feature. The Columbia River has an average regulated discharge of approximately 5,663 cubic meters per second (m<sup>3</sup>/s) (200,000 cubic feet per second [cfs]) at McNary Dam. Discharge varies seasonally and from year-to-year. Typically, high flows of 6,796 to 7,929 m<sup>3</sup>/s (240,000 to 280,000 cfs) occur through April and June. Low flows occur in August through November and typically are in the range 3,030 to 3,228 m<sup>3</sup>/s (107,000 to 114,000 cfs).

### *Local Hydrology*

The proposed power plant site is currently undeveloped and includes no defined natural drainage channels. Because the site is flat and soils at the site are permeable, precipitation percolates directly into the ground or briefly accumulates in ponds and then percolates into the ground or evaporates.

The reach of the Umatilla River near the proposed power plant site lies within an approximately 12 meter (40 feet) deep incised channel. The 100-year flood plain is within the channel.

### *Surface Water Management*

Flows in all major rivers and creeks in the project area are extensively managed. Large winter flows are captured in reservoirs and released as needed for agricultural irrigation and hydropower generation. Most of the surface water in the streams of the Umatilla Basin has been appropriated for agricultural use. Cumulative water rights on many streams exceed available flows in summer months. The Umatilla River Basin Plan (State of Oregon, 1988), which regulates and guides future water development in this basin, prohibits further withdrawal of water from the Umatilla River and its tributaries in the Umatilla Plateau sub-basin from June 1 through October 31 of each year (OAR Chapter 690, Division 507).

The Columbia River provides water for many, sometimes competing, beneficial uses. Beneficial uses of the Columbia River include irrigation, navigation, hydropower, flood control, recreation, municipal and industrial water supply, and fish and wildlife use. Three Federal agencies, including BPA, the US Army Corps of Engineers (Corps), and the Bureau of Reclamation, are currently undertaking a major review of the river and its management in an attempt to reconcile all of the competing uses. Additionally, although existing water rights are being honored, Oregon and Washington each have a current moratorium on granting new water rights on the Columbia River except under certain limited conditions (OAR Chapter 690, Division 519; Washington Administrative Code [WAC] 173-563-015(2)).

### *Surface Water Quality*

Water quality in the reach of the Columbia River near the proposed project is good. Water quality data for the Columbia River are shown in Table 3.3.1.

### Groundwater

The proposed power plant site is located in the Butter Creek Ground Water Control Area, as designated by the Umatilla Basin Plan. Local and regional groundwater aquifers in this area are frequently used to supplement surface water supplies for irrigation. This has led to overdrafting

of groundwater aquifers. Irrigators have begun attempting to recharge shallow aquifers and increase soil moisture with surface water diverted during the winter.

The overall project area is underlain by two groundwater aquifers, a deep aquifer and a shallow aquifer. In general, groundwater elevations indicate that groundwater flow is from south to north, toward the Columbia River. Local variations in flow directions may occur in the shallow aquifer and are influenced by topography and intervening drainages. Each aquifer is described below.

#### *Shallow Aquifer*

The shallow aquifer in the project area is located in the unconsolidated and unconfined sand and gravel deposits that overlie the basalt bedrock in the region. In the project area, permeable gravel interbeds supply water to several high-yielding wells. The aquifer is 31 to 38 meters (100 to 125 feet) thick, with a saturated zone averaging eight meters (25 feet) and ranging from five to 38 meters (15 to 125 feet) thick. Water levels in this aquifer were generally around 17 meters (55 feet) below the ground surface in 1975. Water levels have been dropping by about 0.5 meter (1.6 feet) per year since the mid-1960s. Recharge is provided by less than 25 percent of precipitation, as well as normal irrigation and leaching in the area.

Based on the topography of the area, the shallow groundwater flow direction appears to be north/northwest, toward the Columbia River. Local variations may exist in response to topographic highs and local creeks such as Butter Creek. In some bottomland areas (i.e., along Butter Creek) clay and clayey gravel layers can confine the downward movement of water and result in perched aquifers within about six meters (20 feet) of the surface. This shallow aquifer is hydrologically connected with the creek, and its level drops as creek flows diminish in the summer and fall. Groundwater resources of the shallow aquifer in the Ordnance Critical Groundwater Area, just west of the site, are closed to further appropriation.

#### *Deep Aquifers*

Water-bearing zones of significant storage capacity are found within the interbeds of the basalt flows that lie beneath the sedimentary deposits in the region. Though poorly connected, these zones are viewed as one system because of the substantial vertical movement of water through joints in the basalt and through uncased wells drilled into the basalt. Basalt depths in the region are about 213 to 335 meters (700 to 1100 feet) below the ground surface. Static water levels in the primary water-producing zones range from 61 to 91 meters (200 to 300 feet) below the surface and have declined significantly for many years because of over-pumping and slow recharge. Groundwater recharge of this aquifer occurs in the Blue Mountains to the south, while natural groundwater discharge is to the Columbia River and its tributaries. Recharge in the project area is limited by the Willow Creek monocline, a geologic feature south of Madison

Ranches that acts as a barrier to groundwater flow from the south. Groundwater resources in the basalt aquifer in both the Butter Creek Critical Ground Water Area and the Ordinance Critical Ground Water Area are closed to further appropriation.

### *Groundwater Quality*

Groundwater data are available from several wells at Madison Farms south of the proposed power plant site. Groundwater levels and quality for the Madison Ranches wells as measured in the early 1990s are listed in Table 3.3.2. The locations of the wells are shown in Figure 3.3.1. Data obtained in the late 1990s and analyzed for the WPCF Permit Modification Request indicated that the total dissolved solids concentration of groundwater averages about 400 mg/L.

### **3.3.2 Environmental Consequences and Mitigation Measures**

Diversion of water from the Columbia River for use by the proposed power plant could potentially have an adverse environmental effect on beneficial uses of the river that depend on in-stream flow. Wastewater and storm water management, reuse and disposal practices and chemical spills at the proposed project could have an adverse effect on surface and groundwater quality. Construction activities associated with the proposed project could result in the discharge of sediment and other substances that could have an adverse effect on surface water quality.

#### Impact 3.3.1 Diversion of water from the Columbia River

Assessment of Impact Water for the proposed Umatilla Generating Project would be obtained from the Port of Umatilla's regional water supply system. Under an existing water right, the Port of Umatilla diverts water from the Columbia River near the city of Umatilla and conveys it to users southward in a 61-centimeter (24-inch) diameter pipeline. The pipeline would be extended to supply water to the proposed project. Further information on the Port of Umatilla's water rights is provided in Section 3.5.

Peak average water demand at the proposed project would be 0.16 m<sup>3</sup>/s (5.76 cfs). Average annual water demand at the project would be 0.15 m<sup>3</sup>/s (5.12 cfs).

As noted above, flow in the Columbia River is typically in the range of 3,030 to 3,228 m<sup>3</sup>/s (107,000 to 114,000 cfs) during the low-flow period in the fall. The water diverted for the proposed project would represent about 0.005 % of river flow during a typical low-flow period and less during high flows. The lowest flows recorded in the Columbia River occurred in the late 1930s before most of the major dams were constructed. The dams have a damping effect on extreme flows, reducing the peak flows and increasing low flows. The lowest flow recorded in more recent years was 1,359 m<sup>3</sup>/s (48,000 cfs) in 1977. Water diverted for the proposed project would represent about 0.01% of river flow during an extremely dry period.

The small change in river flow attributable to the proposed project would not be expected to have any significant adverse effect on beneficial uses or water quality in the river. Beneficial uses of the Columbia River include protection of fish and wildlife, agricultural irrigation supply, municipal and industrial supply, navigation and hydropower generation. Diversion of water for the proposed project water have no effect on the ability of downstream municipal, industrial or agricultural water users to obtain the water they are permitted to divert. The amount of water diverted for the proposed project would have no measurable effect on water levels and consequently would not affect navigation. The amount of water in the river available for generation of hydropower at downstream dams would be slightly reduced. It was estimated that a similar energy facility now under construction a few miles upstream of the proposed project would reduce power generation at the downstream dams by 756 megawatt hours annually (Hermiston Power Partners, EIS, 1997). Using the same operating assumptions for the downstream dams the reduction in power generation downstream attributable to the proposed project would be 1,036 megawatt hours. This represents about 0.003 percent of the average annual electric power output of the downstream dams.

The potential effects of the proposed project on fish are discussed in Section 3.5 of this EIS. Some believe that locating electrical generating facilities in the Umatilla area would benefit fish in the reach of the Columbia River below the major hydropower dams because it may enable those dams to spill more water (Personal communication, Scott Bettin, BPA, 19 June 2001).

#### Mitigation Measures included in the Proposed Project

The proposed power plant would include a number of features that reduce water use. A recirculating cooling system using cooling towers with high-efficiency drift eliminators would reduce the volume of water needed to cool the turbines compared to that required by a once-through cooling system. All wash water and other aqueous wastewater streams produced at the proposed power plant would be recycled and used a second time as cooling water. The proposed power plant would employ equipment that does not require water for removing nitrogen oxides from exhaust gases.

#### Other Possible Mitigation Measures

The effects of the proposed project on the Columbia River could be further reduced by substituting a dry cooling system for the proposed recirculating water cooling system. The applicant evaluated this potential mitigation measure but rejected it because it would reduce the efficiency of the energy facility and increase its operating cost. Overall the adverse environmental effects of water diversion from the river would be insignificant.

### Impact 3.3.2 Wastewater and storm water discharge during project operation could affect surface and groundwater quality

Assessment of Impact Sanitary sewage, process blowdown, cooling system blowdown and stormwater runoff would be generated by the proposed power plant. Process blowdown, consisting of wash water, filter backwash, and other non-sanitary liquid wastes produced by the proposed power plant, would be recycled to the cooling system.

No wastewater from the proposed project would be routed to a municipal sewage treatment plant. Cooling system blowdown is essentially clean water which municipal treatment plant operators are often reluctant to accept because it decreases the effectiveness of conventional wastewater treatment processes. The volume of sanitary sewage produced at the proposed project site is too small to justify construction of a pipeline to the nearest sewage treatment plant in Hermiston.

#### *Sanitary sewage*

Sanitary sewage would be routed to an on-site disposal system consisting of a septic tank and leach field located at the proposed power plant site. The average volume of sanitary sewage would be 1,893 l/day (500 gal/day). The on-site disposal system would be designed in accordance with Umatilla County's standards for on-site disposal systems. Percolation into the ground of treated sanitary sewage from the septic system from the proposed power plant would not have a significant adverse effect on groundwater quality.

#### *Cooling system blowdown*

Cooling system blowdown is essentially clean water with an elevated total dissolved solids content. It is expected that, on average, water in the cooling system would circulate in the cooling system ten times. About 90% of the water entering the cooling system would be evaporated and the remainder would be discharged as blowdown. The total dissolved solids content of blowdown would be approximately ten times that of the source water. The total dissolved solids content of Columbia River water varies somewhat seasonally, but in the reach of the river near the proposed project, it is typically in the range of 110mg/L to 120 mg/L (WPCF Permit Modification Request, Hermiston Generating Company, L.P., 2001). Cooling system blowdown from the proposed project would have a total dissolved solids content of 1,100 to 1,200 mg/L.

Three water-conditioning chemicals would be added in small quantities to the cooling system to control pH, prevent growth of algae, and prevent build up of scale. They are sulphuric acid,

sodium hypochlorite solution and Betz 430, a proprietary scale inhibitor. The primary constituents of Betz 430 are HEDP and polyacrylic acid.

It is expected that about 818 kilograms (1,800 lbs) of sulphuric acid would be used each day to maintain pH in the neutral to slightly acidic range. An estimated 13 to 26 liters (50 to 100 gallons) of sodium hypochlorite solution would be used each day to prevent growth of algae. About five liters (17 gallons) of Betz 430 would be added to the cooling system each day.

Cooling system blowdown from the proposed power plant would be reclaimed and reused at Madison Farms for irrigation of cropland in accordance with the WPCF permit issued by ODEQ. Madison Farms is located about five kilometers (three miles) south of the proposed power plant site as shown in Figure 2.11. Cooling system blowdown would be conveyed to Madison Farms in a pipeline shared with the Hermiston Generating Plant, which is located approximately 0.8 kilometer (0.5 mile) east of the proposed power plant.

At Madison Farms, blowdown from the proposed power plant and the Hermiston Generating Plant would be applied to cropland. During the growing season, blowdown would be supplied to center pivot irrigation systems and used to irrigate crops. During the winter, blowdown would be land applied using the same center pivot irrigation systems.

The quantity of blowdown that would be applied to a given acre each year would be regulated by ODEQ to protect water quality. Blowdown water would provide a portion of the crops' water requirement. Columbia River water from Madison Farms' other water sources would provide the balance. Approximately 688 hectares (1,700 acres) of irrigated cropland are needed to meet the combined disposal requirements of the proposed power plant and the Hermiston Generating Plant. This acreage has been allocated by Madison Farms.

As mentioned in the previous paragraph, a Water Pollution Control Facility (WPCF) permit issued by ODEQ regulates the reuse and disposal of blowdown from the Hermiston Generating Plant at Madison Farms. It is expected that ODEQ will modify the existing WPCF permit to allow the joint reuse and disposal of blowdown from the proposed power plant and the Hermiston Generating Plant. It is also expected that the effects of joint reuse and disposal on groundwater quality would be similar to those of the current reuse and disposal operation. The primary regulated constituent in blowdown is total dissolved solids. No significant adverse effect on the total dissolved solids content of groundwater would be expected, because the amount of total dissolved solids applied to a given acre annually would be no greater than the amount applied if the crops were irrigated with existing well water on Madison Farms. Madison Farms projects that the total dissolved solids content of the mixture of blowdown and Columbia River water that would be applied to cropland would be equal to or lower than the total dissolved solids content of groundwater. The total dissolved solids content of ground water in the area

varies from well to well, but averages about 400 mg/L. The applied water would have a similar total dissolved solids content.

The water conditioning chemicals added to the cooling system in small quantities would have no adverse effects on crops or groundwater. The pH of the reclaimed water would be close to neutral. The small chlorine residual maintained in the cooling system by addition of sodium hypochlorite would be dissipated by the time reclaimed water arrives at Madison Farms. The concentrations of HEDP and polyacrylic acid in reclaimed water would be lower than as required for drinking water.

Cooling water conditioning practices at the proposed energy facility would be the same as those at the nearby Hermiston Generating Project. Blowdown from the Hermiston Generating Plant is used as process water by a potato processing plant and must meet drinking water standards and standards set by the Food and Drug Administration.

#### *Storm Water*

Storm water from roofs and paved areas would be collected and discharged to a lined detention basin where most of it would evaporate. Excess storm water would be pumped from the detention pond to the cooling tower basin where it would be used as cooling water make-up. Storm water from the area of the power block would be drained to area sumps where it would be processed by an oil/water separator. Any oily component would be collected and removed by a licensed waste disposal contractor. The aqueous component would be routed to the cooling tower basin, where it would be used for cooling water make-up. Because storm water would either be evaporated or reused for cooling purposes, it would have no effect on surface or groundwater quality.

Recommended Mitigation Measures No measures beyond those included in the proposed project are recommended.

#### Impact 3.3.3 Chemical spills at the proposed power plant could affect surface and groundwater quality

Assessment of Impacts Various chemicals, such as cooling tower additives (sulphuric acid, sodium hypochlorite, scale inhibitor), would be stored at the proposed power plant site in permanent above-ground storage tanks and in temporary containers (totes). All chemical storage would be in curbed concrete areas. If a tank or other primary containment ruptured, the volume of the secondary containment (curbed concrete area) would be sufficient to temporarily store the chemical until clean-up by a licensed spill response contractor could be accomplished. In the unlikely event that a spilled chemical entered the storm water drainage system, tertiary containment would be provided by the storm water detention basin. Because of these design



features, any chemical spill that might occur at the proposed power plant would not adversely affect surface or groundwater quality.

Recommended Mitigation Measures No measures beyond those included in the proposed project are recommended.

Impact 3.3.4 Wastewater and storm water discharge during project construction could affect surface and groundwater quality

Assessment of Impacts Sanitary wastewater would be produced at construction sites during the construction period. Chemical toilets would be provided at all construction sites. A contractor would supply the toilets and transport sewage to a municipal sewage treatment plant for treatment and disposal. Consequently, disposal of sanitary wastewater from the proposed power plant would have no adverse effect on surface or groundwater quality.

Construction activities would result in disturbance of soil surfaces. If precipitation occurs during the construction period, soil particles could be carried by runoff into surface waters with a consequent adverse effect on surface water quality. This is not expected to be a serious problem at the proposed project's construction sites, because the sites are flat and soils very permeable. Most precipitation would percolate into the ground rather than run across the soil surface. Thus, storm water runoff from construction sites would not have an adverse effect on water quality.

Although contamination of surface water bodies as a result of runoff from construction sites is not expected to be a serious problem for the reasons noted above, the construction contractor would be required to adopt standard practices for control of soil erosion at construction sites. These practices would include installation of silt fences and reseeding of exposed soil surfaces. A settling pond would be constructed at the downstream end of the power plant construction site.

Recommended Mitigation Measures No measures beyond those included in the proposed project are recommended.

### **3.3.3 Cumulative Impacts**

The proposed project would use water diverted from the Columbia River by the Port of Umatilla, consistent with the port's existing water rights. The Port of Umatilla has a municipal water permit issued by the Oregon Water Resources Department that allows the port to divert up to 4.39 cubic m<sup>3</sup>/s (100.17 million gallons per day (mgd)) from the Columbia River. A portion of this allotment is withdrawn and pumped south from the Columbia River for use by several entities including the City of Hermiston, J.R. Simplot, Lamb-Weston, Inc., the Hermiston Generating Plant and First Oregon Land Corporation. First Oregon Land Corporation, an affiliate of Umatilla Generating Company, L.P., will transfer its allocation of water to the

Umatilla Generating Company for use by the proposed project. The Umatilla Generating Company, L.P. would receive a maximum of 0.16 m<sup>3</sup>/s (3.74 mgd) or about 2 percent of Port of Umatilla's water right. The Port of Umatilla expects to begin supplying water to another electric power generation project, the Hermiston Power Partners project, within the next year.

In addition to the Port of Umatilla, there are many other diversions of water from the reach of the Columbia River near the City of Umatilla. There are ten major water withdrawal points in Oregon according to the water rights map provided by Oregon Water Resources Department for the Columbia River between the City of Irrigon and Cold Springs Canyon. Examples of existing water rights include 0.017 m<sup>3</sup>/s (0.605 cubic foot per second) for irrigation of 9.8 hectares (24.2 acres) owned by Royale Columbia Farms, Inc.; 0.03 m<sup>3</sup>/s (0.89 cubic foot per second) for gravel washing owned by Logsdon Ready-Mix, Incorporated; and 0.3 m<sup>3</sup>/s (11.6 cfs) from four wells in the Columbia River Basin for fish culture operated by the Bonneville Power Administration and the Army Corps of Engineers (Oregon Water Resources Department 2001). The Coyote Springs electric power generation which is currently under construction about ten miles west of the proposed project will obtain water from the Port of Morrow. The Port of Morrow obtains its water from the Columbia River and from wells that are hydraulically connected to the river.

Past diversion of water from the Columbia River for various purposes, principally agricultural irrigation, together with the construction of hydropower and other dams have radically altered the river's flow regime from its pre-development condition. The changes in flow regime and the discharge of contaminants by cities, industries and agriculture have had an adverse effect on river water quality and on the fishery in the river.

River flow could be diminished in the future by additional withdrawals of water but probably only to a rather limited extent. Although some permitted municipal water rights that have not been developed to the maximum extent allowable (including the Port of Umatilla's right) could be developed in the future, it is unlikely that many new rights will be granted. The listing of several salmon species pursuant to the Endangered Species Act has increased regulatory scrutiny of applications to withdraw water from the Columbia River. Currently, the states of Oregon and Washington are only granting permits for new withdrawals under very limited circumstances. Furthermore, the National Marine Fisheries Service has stated that it will oppose any new withdrawals that are not offset by corresponding reductions in existing withdrawals. Consequently, it is expected that all new industrial or power generation projects that are proposed for the lower and middle reaches of the Columbia River basin, and which opt to use surface streams as their water source, would rely on existing water rights. Any reduction in flow attributable to future industrial, power generation or agricultural irrigation projects is likely to be limited by the fact that future diversions will themselves be limited to the amount of water that can be diverted under existing permitted water rights.

The proposed project, in concert with other future projects and projects under construction that rely on existing but currently undeveloped or underdeveloped water rights, would contribute to a

further diminution of flow in the Columbia River. Any cumulative adverse consequence of the proposed project and other future projects for beneficial uses of the river is expected to be relatively minor however, because no new water rights are expected to be granted. The adverse changes that have occurred in the Columbia River and its ecosystem are largely attributable to past practices, particularly the construction of large instream dams and reservoirs and large scale diversion of water for agriculture. The adverse cumulative effects of water diversion for the proposed project and other power projects in the vicinity are expected to be insignificant relative to adverse cumulative effects of past actions.

Wastewater from the proposed project would be reclaimed and applied to cropland in an area, several miles south of the proposed power plant site. Reclaimed water would be blended with surface water from another source to reduce its total dissolved solids content to a level no greater than would occur if groundwater were used for irrigation. The conditions under which reclaimed water could be applied to the land would be specified in a Water Pollution Control Facility Permit issued by the Oregon Department of Environmental Quality.

Agricultural irrigation in arid areas usually results in declining water tables and a build-up of sodium chloride and other salts in the soil and underlying groundwater. In the Butter Creek Ground Water Control Area where the reclaimed water would be applied, salts, transported out of the soils around plant roots by the leaching fraction of irrigation water, are carried down into the geological profile. Because of the great depth to groundwater, ranging from 52 meters to greater than 61 meters (170 feet to greater than 200 feet) and the existence of restricted zones created by geologic barriers, it is expected that salts will be prevented from concentrating in the groundwater. Therefore, it is unlikely that the proposed project would adversely impact ground water quality (Thurman 2001).

**Table 3.3.1:**  
**Summary of Columbia River Water Column Measurements**  
**Made by the Washington Department of Ecology at Umatilla**

Parameter	Geometric Mean
<b>Conventional Constituent</b>	
Temperature	9.06°C
Conductivity	161.19 µmhos <sup>1/</sup>
Dissolved oxygen	11.36 mg/l
PH	7.99
Suspended solids	8.44 mg/l <sup>2/</sup>
Ammonia-N	0.02 mg/l
Total phosphorous	0.03 mg/l
Hardness	66.34 mg/l as CaCO <sub>3</sub>
Turbidity	1.97 turbidity units
Fecal coliforms	6.09 colonies/100 ml
Alkalinity	63.13 mg/l
Nitrite-Nitrate	0.11 mg/l
Dissolved nitrite	0.01 mg/l
<u><b>Metals</b></u>	
Chromium	0.43 µg/l <sup>3/</sup>
Copper	2.39 µg/l
Lead	1.00 µg/l
Zinc	5.99 µg/l
Cadmium	0.12 µg/l
Mercury	0.06 µg/l

**Source:** Washington Department of Ecology Ambient Monitoring Program, Umatilla Bridge Station on the Columbia River.

<sup>1/</sup>µmhos – unit of conductivity; reciprocal of µohms

<sup>2/</sup>mg/l – milligrams per liter

<sup>3/</sup>µl – micrograms per liter

**Table 3.3.2:  
Groundwater Quality in the Vicinity of the Proposed Project**

<b>Well #</b>	<b>Total Depth (feet)</b>	<b>Water Level Elevation (msl)</b>	<b>Total Dissolved Solids (mg/l)</b>	<b>Chloride (mg/l)</b>	<b>Nitrate (mg/l)</b>	<b>Hardness (mg/l of CaCO<sub>3</sub>)</b>
1	17	no water in bore hole	347	7.54	3.75	194
2	172	609.7	224	6.07	0.26	87.2
3	38.5	586.1	522	99.2	2.74	573
4	61	578.1	366	12.2	0.74	344
5	17	628.6	449	17.7	4.33	525

Source: Grasseti Environmental Consulting 1993

msl – mean sea level

mg/l – milligrams per liter